North Carolina Utilities Commission
Public Staff

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Disclaimer

This ratemaking presentation provides a high level overview of the general ratemaking process for regulated utilities in North Carolina. Ratemaking is a fact-specific process, thus examples discussed herein may not always predict the outcome of any particular issue coming before the NCUC. The purpose of this presentation is to provide the audience with a better understanding of the framework within which decisions are made and the issues that regulators must weigh when reaching those decisions and should not be construed as offering opinions regarding the Public Staff's position in any present or future case. Many of the graphs contained herein are fictional examples for illustrative purpose only and should not be cited or relied upon.

What is the Utilities Commission?

- Began in 1891 as the Railroad Commission
- Seven commissioners serving six year terms
  - Appointed by Governor
  - Confirmed by General Assembly
- Implements Chapter 62 of the General Statutes
- Enforces the traditional regulatory bargain
  - Utility receives monopoly service territory
  - Utility obligated to provide adequate service at reasonable rates
- Obligation to be fair to public utilities and their customers

Key Functions of Utilities Commission

- Adjudicate utility requests for changes in rates and terms of service
  - General rate case and rider proceedings
  - Approve new utility programs
- Adjudicate formal customer complaints
- Adjudicate need for new utility plant construction
  - Certificates of Public Convenience and Necessity
- Evaluate requests for changes to utility service territory
- Establish biennial avoided costs
- Enforce Renewable Energy Portfolio Standards compliance
- Arbitrate disputes between utilities

What Is The Public Staff?

- Established in 1977 by N.C. Gen. Stat. § 62-15
- Represents the using and consuming public in North Carolina Utilities Commission proceedings
  - Not the public at-large
  - Economic regulator and advocate
- Eighty staff members organized into nine divisions
  - Electric, natural gas, water/sewer/communications, transportation
  - Accounting
  - Legal
  - Economic Research
  - Executive
  - Consumer complaint analysts

Key Functions of Public Staff

- Auditing regulated utilities in Commission investigations and proceedings and presenting testimony of findings
- Investigating customer complaints
- Assisting legislative staff, legislators and Governor's office regarding proposed legislation and constituent services
- Working with other State agencies, counties, and municipalities on regulated utility matters
- Undertaking studies and making recommendations to the Commission regarding:
  - New service offerings and changes to existing services
  - Construction of new generating facilities and transmission lines
  - Mergers and acquisitions involving public utilities
- Facilitating stakeholder and working groups as requested by the Commission
- Serve as educational resource to customers and educational institutions

Differences Between NCUC and Public Staff

- Independent agencies
  - <u>Separate</u> staffs, leadership and budgets
- NCUC <u>does not direct or oversee</u> the Public Staff's operations
- Public Staff appears as a party before the NCUC
  - Public Staff <u>subject to ex parte rules</u> and cannot independently communicate with NCUC on pending matters
  - Public Staff <u>does not participate</u> in NCUC decision-making
- Staff roles
  - NCUC staff is an advisory staff
  - Public Staff is an audit/advocacy staff

Regulated Utilities

- NCUC regulates the rates and service of "public utilities" as defined in Chapter 62 of North Carolina General Statutes
  - Producing or delivering a utility service to the public for compensation
    - If you give utility service away for free, you are not a regulated public utility
- Public utilities are usually private, investor-owned entities
  - Considered to be a "public" utility because they are entities affected with the public interest

Non-Regulated Utility Rates

- Municipal utilities
  - Rates are set by municipality or related board
- Electric membership cooperatives
  - Rates are set by member-elected board of directors
- Water/sewer authorities and sanitation districts
  - Rates set by governing board selected by participating municipalities

Fundamental Ratemaking Questions

- It is important to understand the framework through which spending decisions are evaluated
  - Utility costs are evaluated using general ratemaking principles
  - If these costs do not conform to cost of service principles, regulators are less likely to allow recovery through rates
- Fundamental question for utilities:

  "Can we recover it through rates?"

- Fundamental questions for regulators:

  "Does it benefit ratepayers?"

  "Is it least cost?"

What Is The Regulatory Compact?

IMPORTANT

Rural Electrification Meeting

To Be Held At

Grange Hall - LEMPSTER, N. H.
MONDAY, NOV. 27, 1939 7:30 P. M.

IF YOU ARE A TENANT, INVITE YOUR LANDLORD

A. M. BLAKENEY, Jr., Washington, D. C.
Asst. Chief of Wiring Section of REA, Will Be Here To Explain

What Is Necessary For You To Do

N O W

To Get Electric Service Quickly

Construction has been started and immediate action is necessary.

ALSO

1—What has been done to lower the cost of wiring.
2—That you cannot obtain your wiring at these low costs, unless you sign a wiring contract before construction is completed.
3—That the electric lines will ultimately belong to you.
4—How to get long term financial assistance for wiring, lighting fixtures and plumbing.

IMPORTANT MESSAGE TO FARM WIVES
Bring your husband if you can, but if you can't, bring your neighbor's wife.

New Hampshire Electric Cooperative, Inc.
Phenix Hotel Phone 1338 Concord, N. H.

What Is The Regulatory Compact?

- In exchange for a regulator granting the utility a protected monopoly within its service territory, the utility commits to supply the full quantities demanded by customers at a regulated price
  - Public utility is not subject to competition within its service territory
  - Public utility has an obligation to serve anyone that requests service
  - Rates are regulated based upon the cost of service, which includes a reasonable rate of return

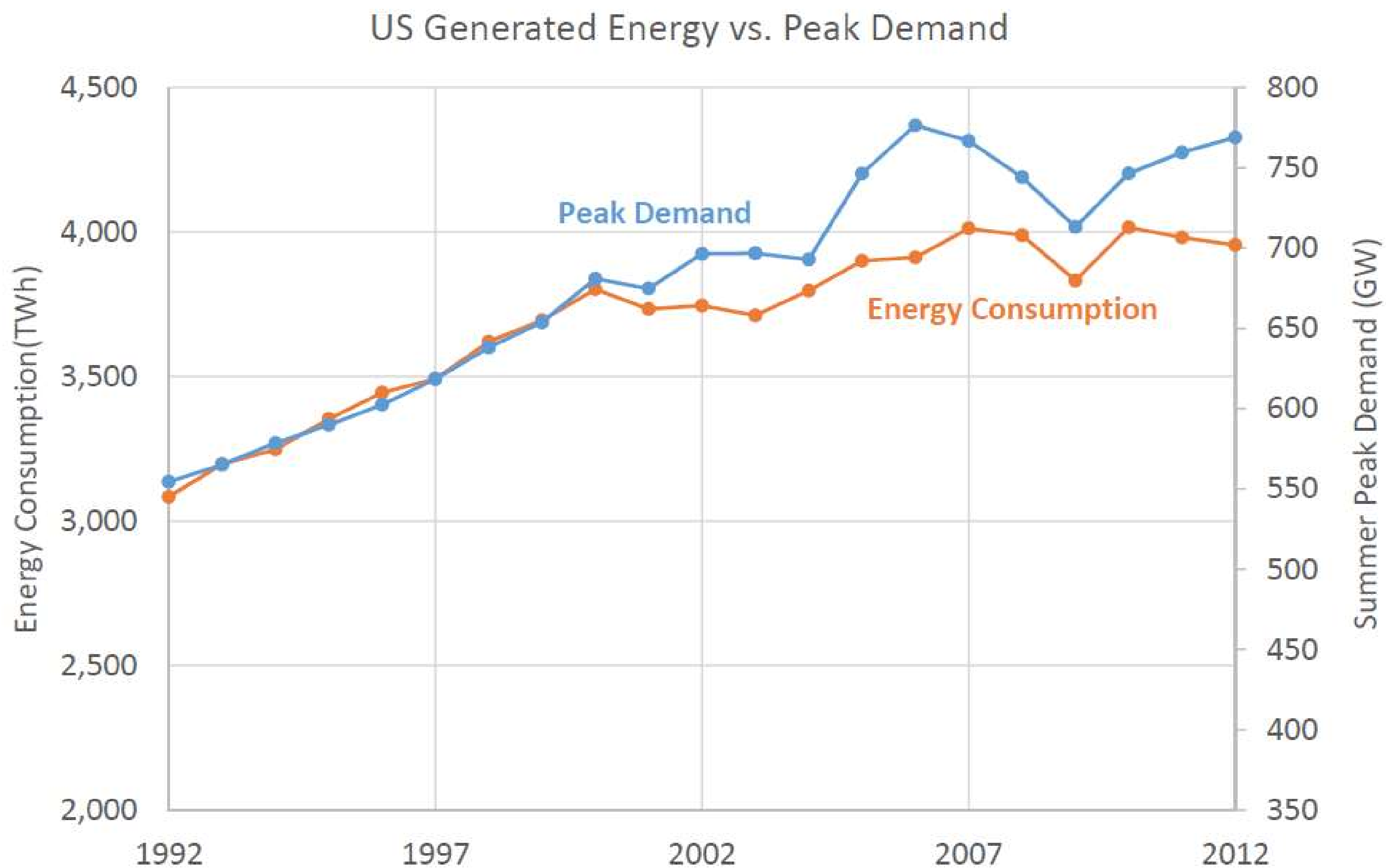
Regulatory Parameters

- Chapter 62 of the N.C. General Statutes establishes utilities regulation
  - Commission is bound by statutory parameters
    - Exercises judgment within those parameters
  - Subject to judicial review
- Commission decisions must be based on sworn evidence
  - Sworn testimony and supporting exhibits
  - Similar to a court
- Commission regulation acts in concert with federal and state regulation
- Public Staff has no authority to direct the utilities

Energy v. Capacity

- Energy is actual electricity being produced or consumed
  - Measured in kilowatt hours (kWh) or megawatt hours (mWh)
- Capacity is the infrastructure needed to produce electricity
  - Measured in kilowatts (kW) or megawatts (mW)
- Average monthly residential consumer bill: $110/month
  - Energy v. capacity
    - 54% composed of energy costs
    - 46% composed of capacity costs
  - Generation v. transmission/distribution
    - 64% composed of generation costs
    - 36% composed of transmission/distribution costs

Energy v. Capacity



Data Source: EIA

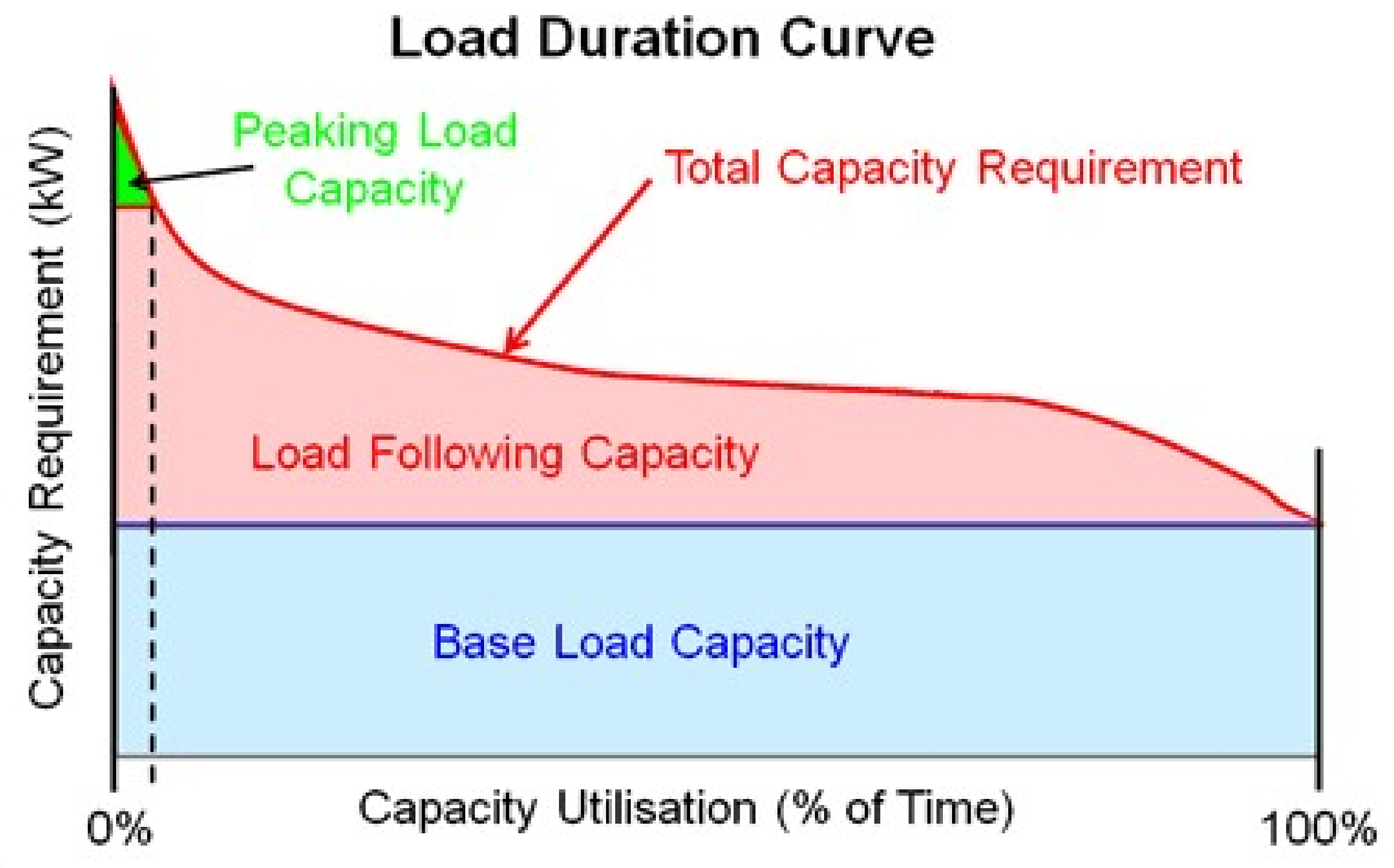
Peak Demand

- Utility must have enough capacity to meet peak demand
- Capacity must be firm and dispatchable
  - When you need power, it has to produce instantly
  - Cannot be intermittent
- When customer demand equals or exceeds generation output, the utility must:
  - Bring additional generation online
  - Purchase power from another source
  - Implement demand response measures
  - Curtail customer usage

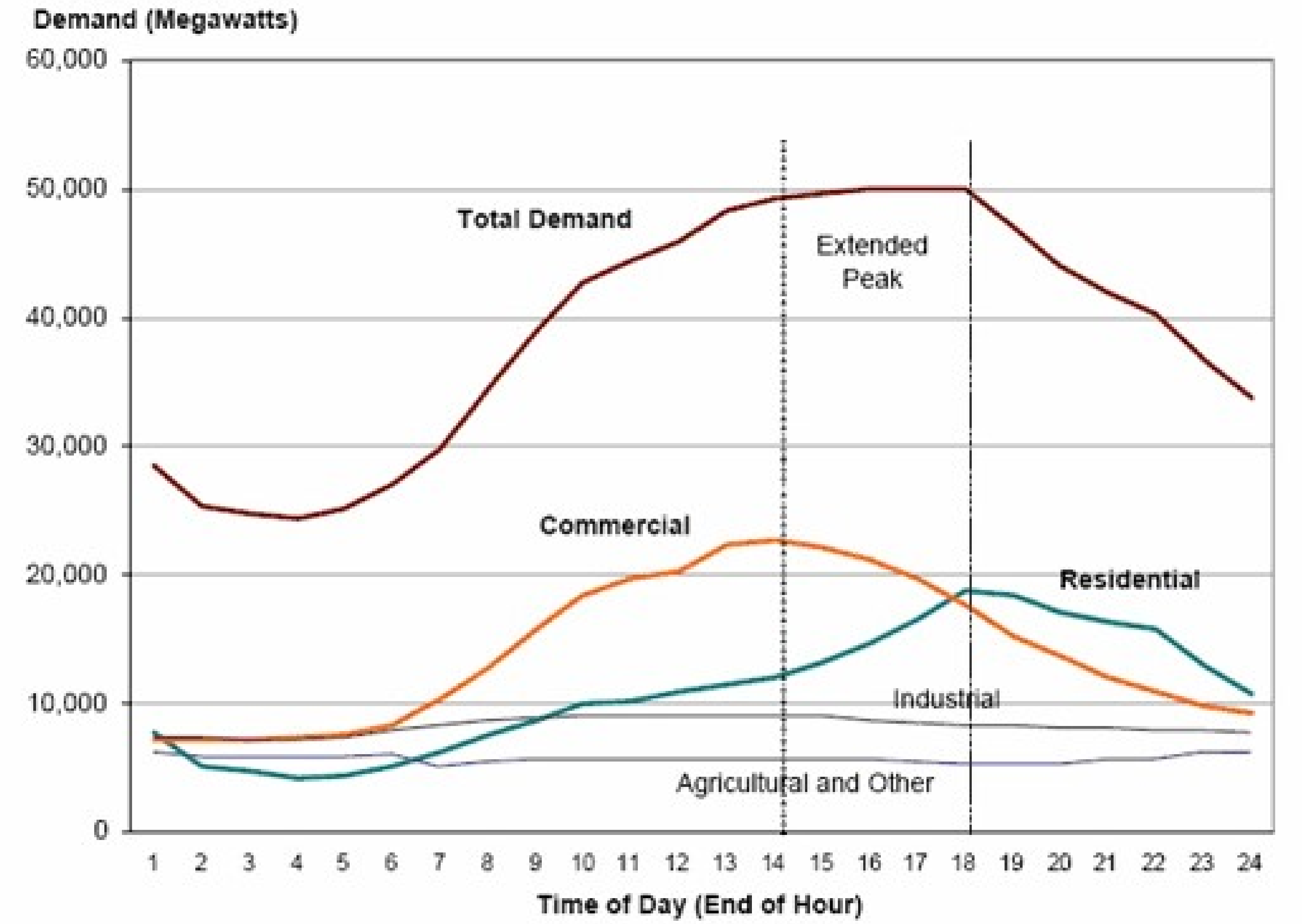
Peak Demand

- Peak demand continues to increase each year
  - No longer correlates to overall energy consumption
- Peak demand driven by variety of devices
  - Air conditioning and heating
  - Washing machines/dryers/dishwashers
  - Ovens/stoves
  - Electronics such as large screen televisions, computers, etc
- System must be sized to meet peak demand
  - All-time system peaks:
    - DEC: 21,623 MW (January 5, 2018 between 7:00 am - 8:00 am)
    - DEP: 15,196 MW (February 20, 2015 between 7:00 am - 8:00 am)

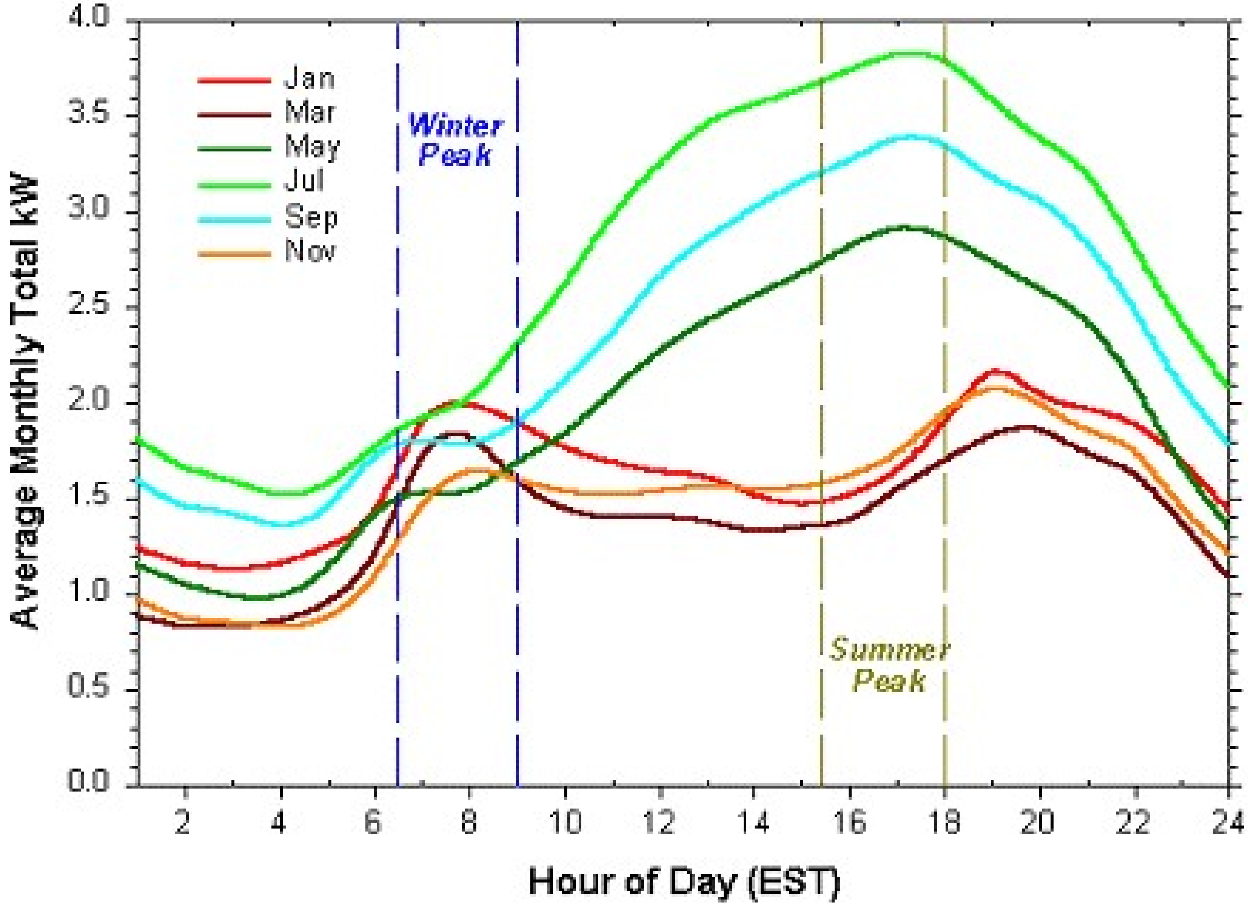
Capacity Requirements and Utilization



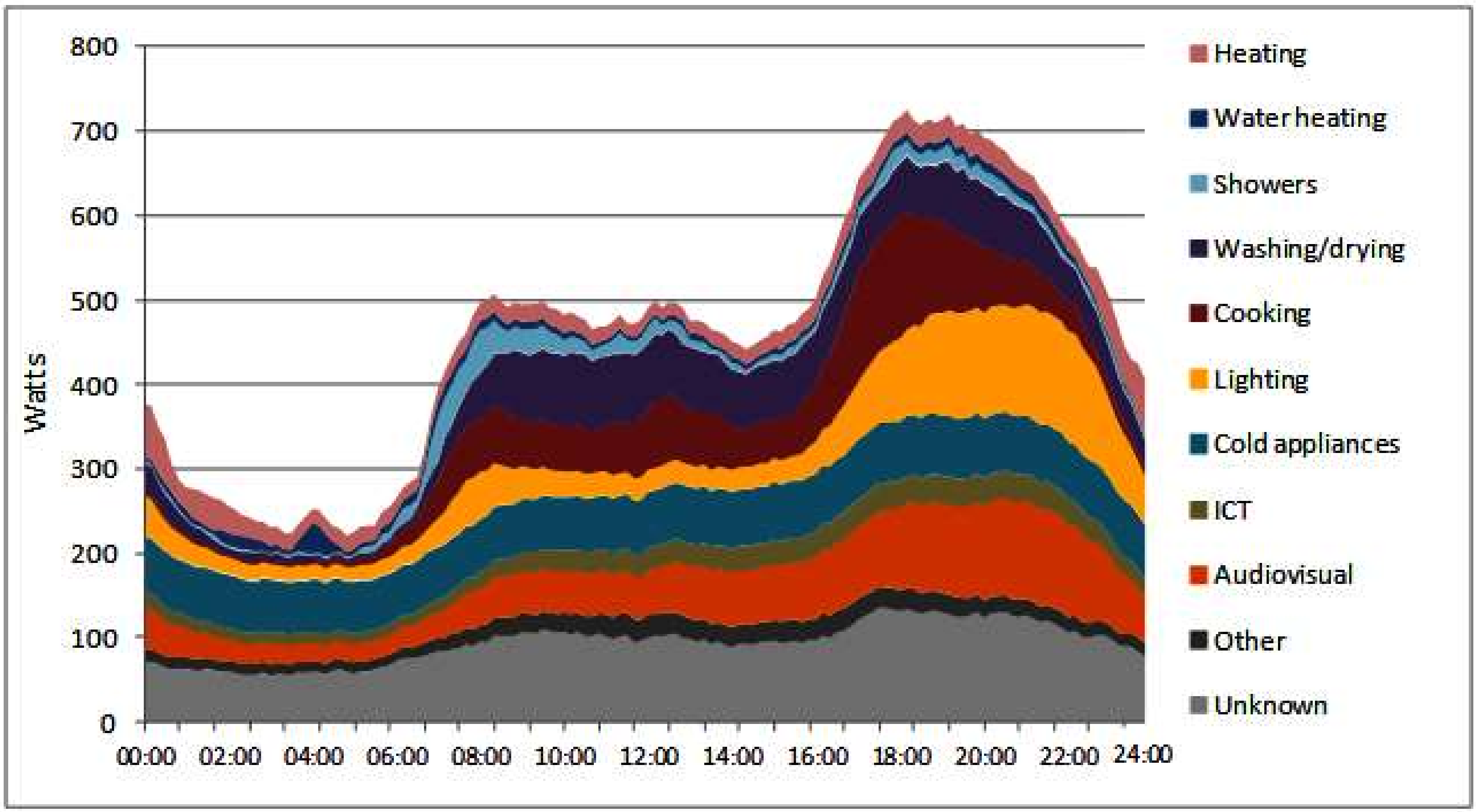
Demand Profiles



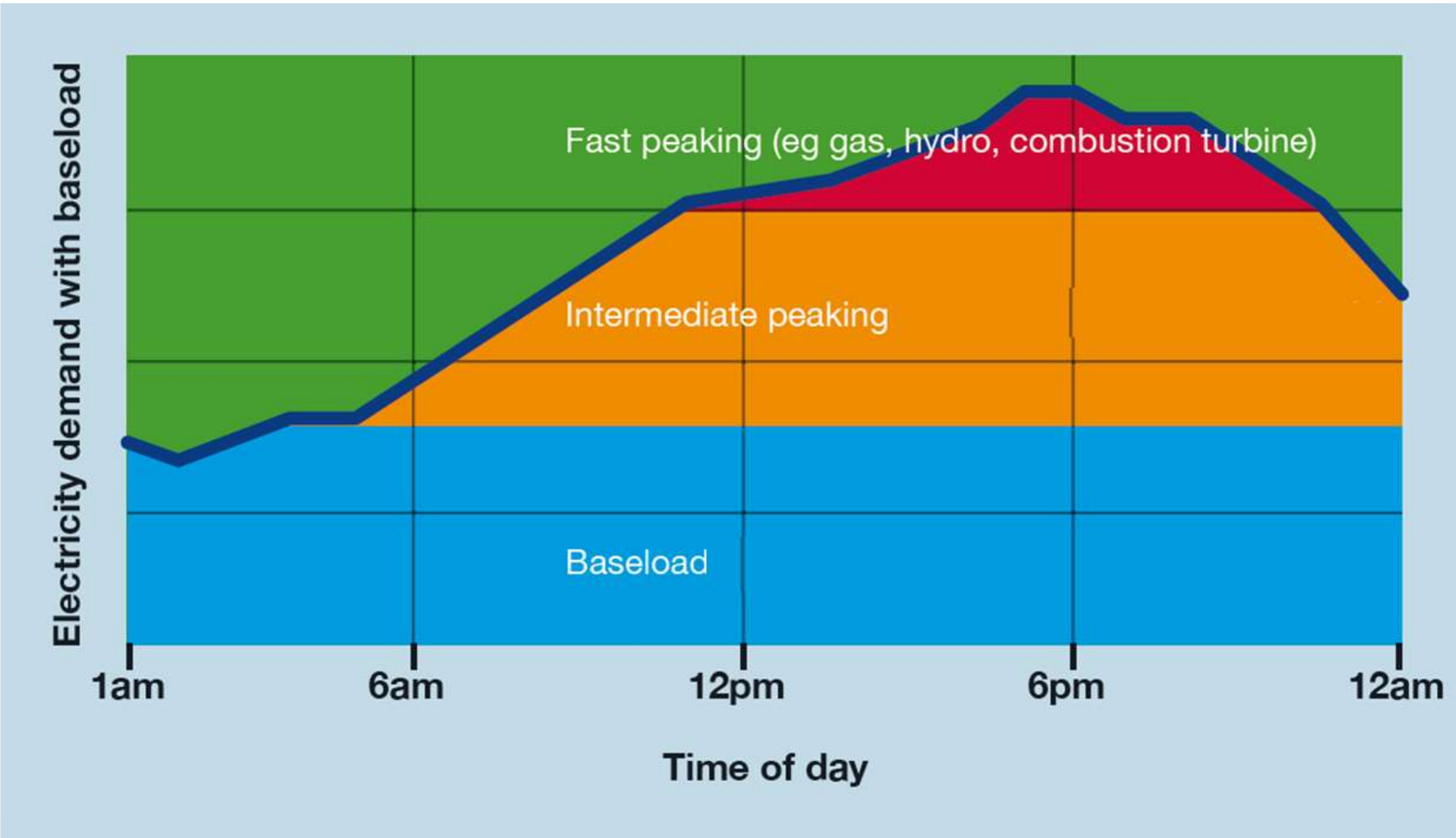
Seasonal Demand Variations



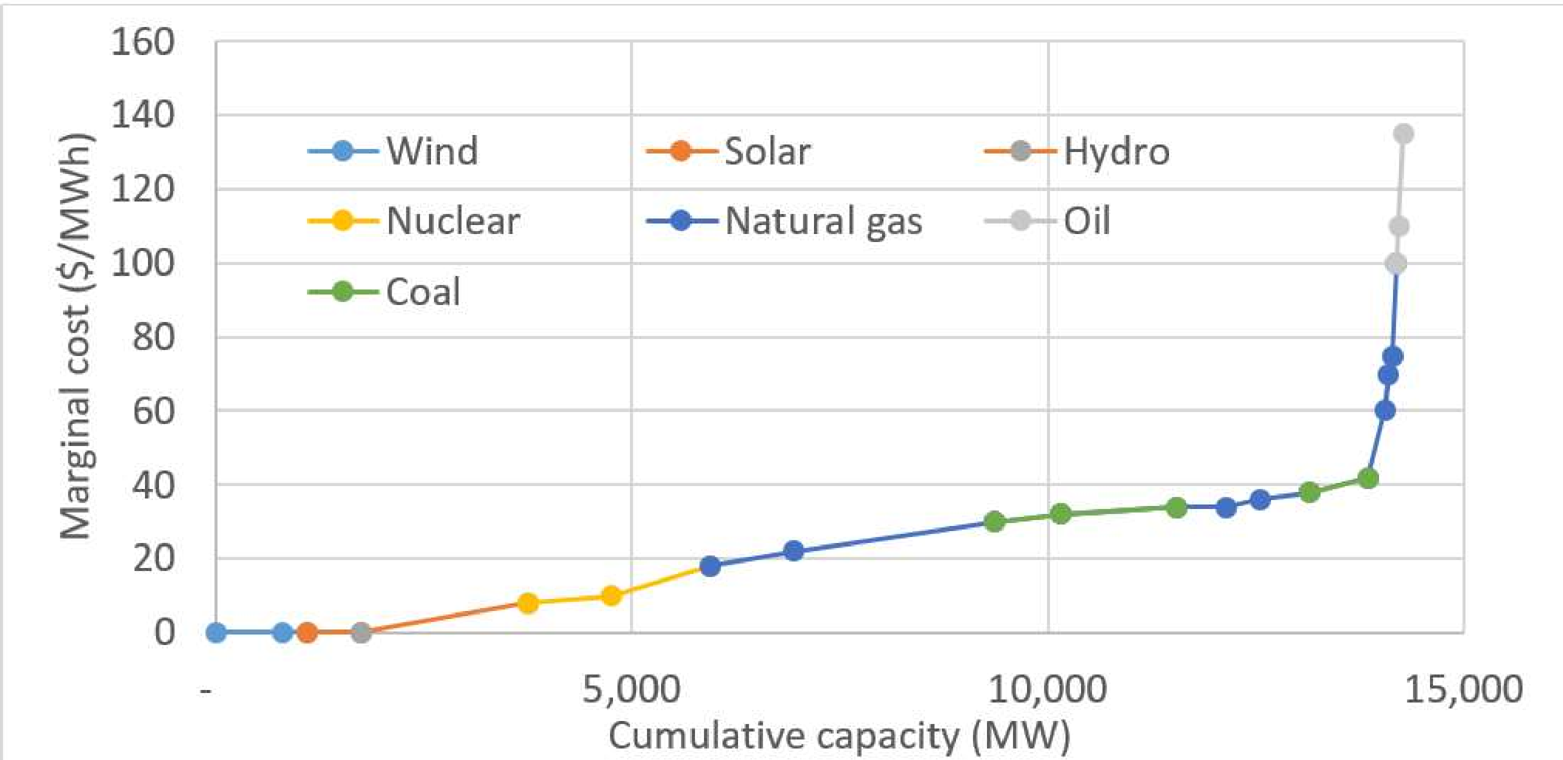
Residential Demand



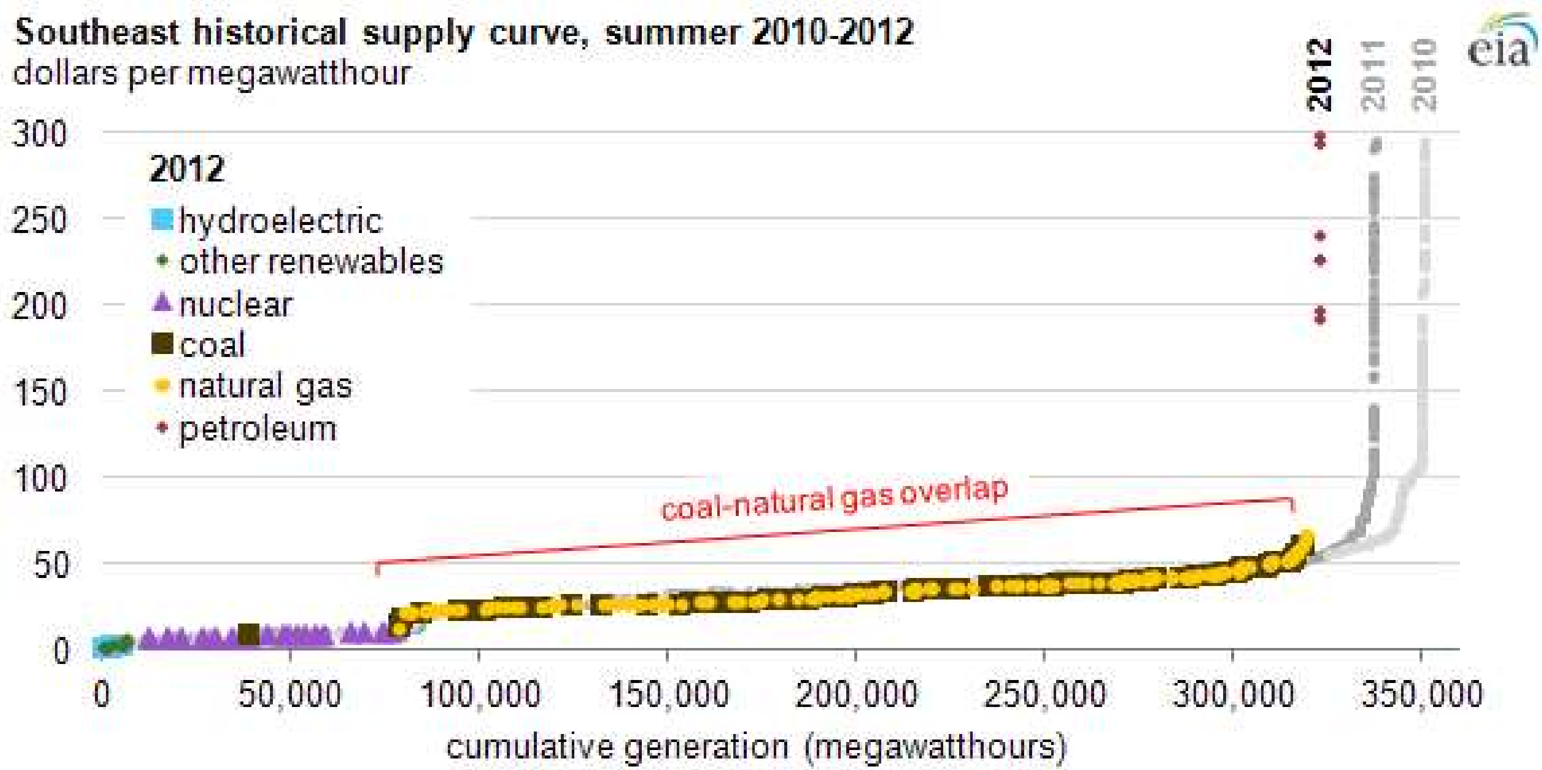
Generation Unit Dispatch



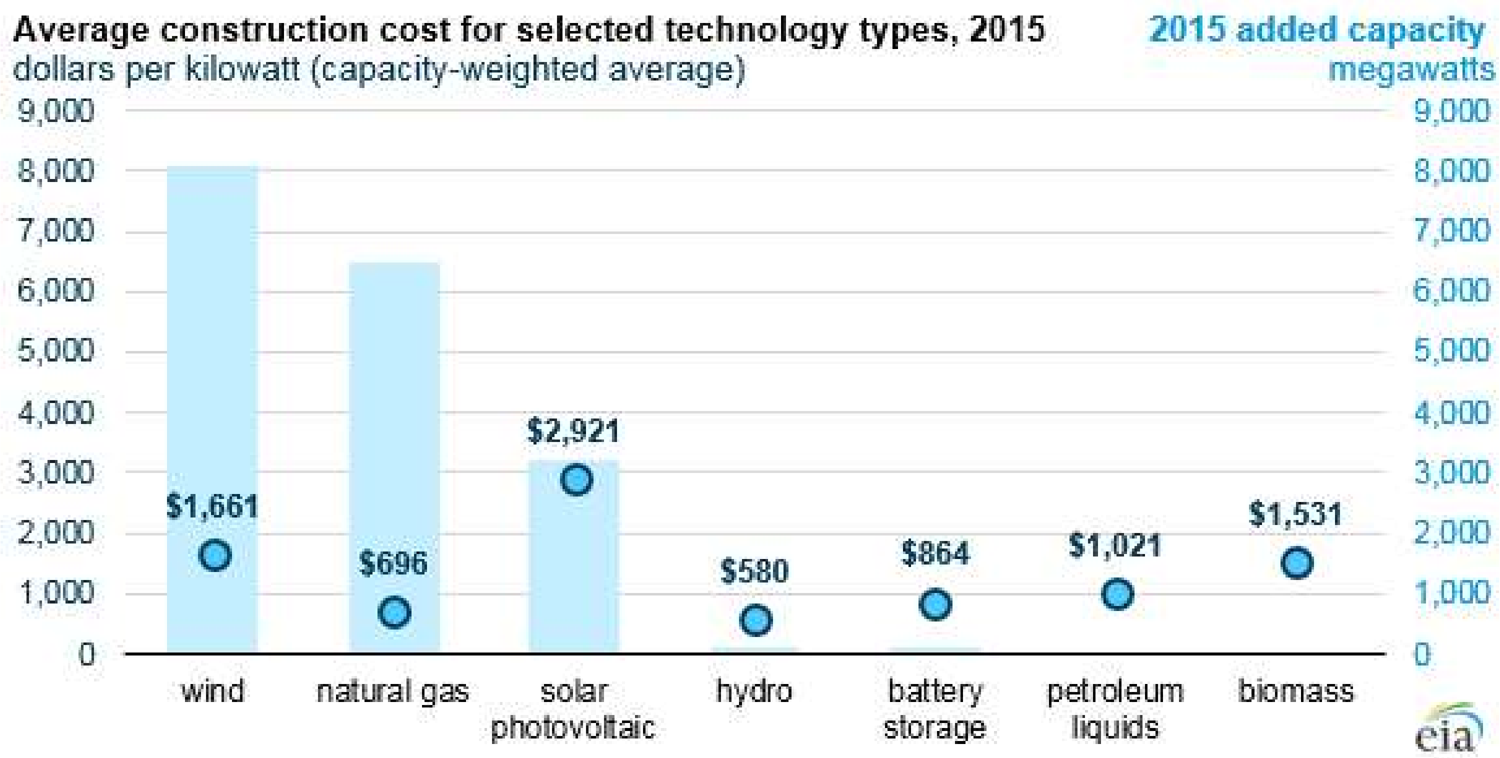
Generation Unit Marginal Cost



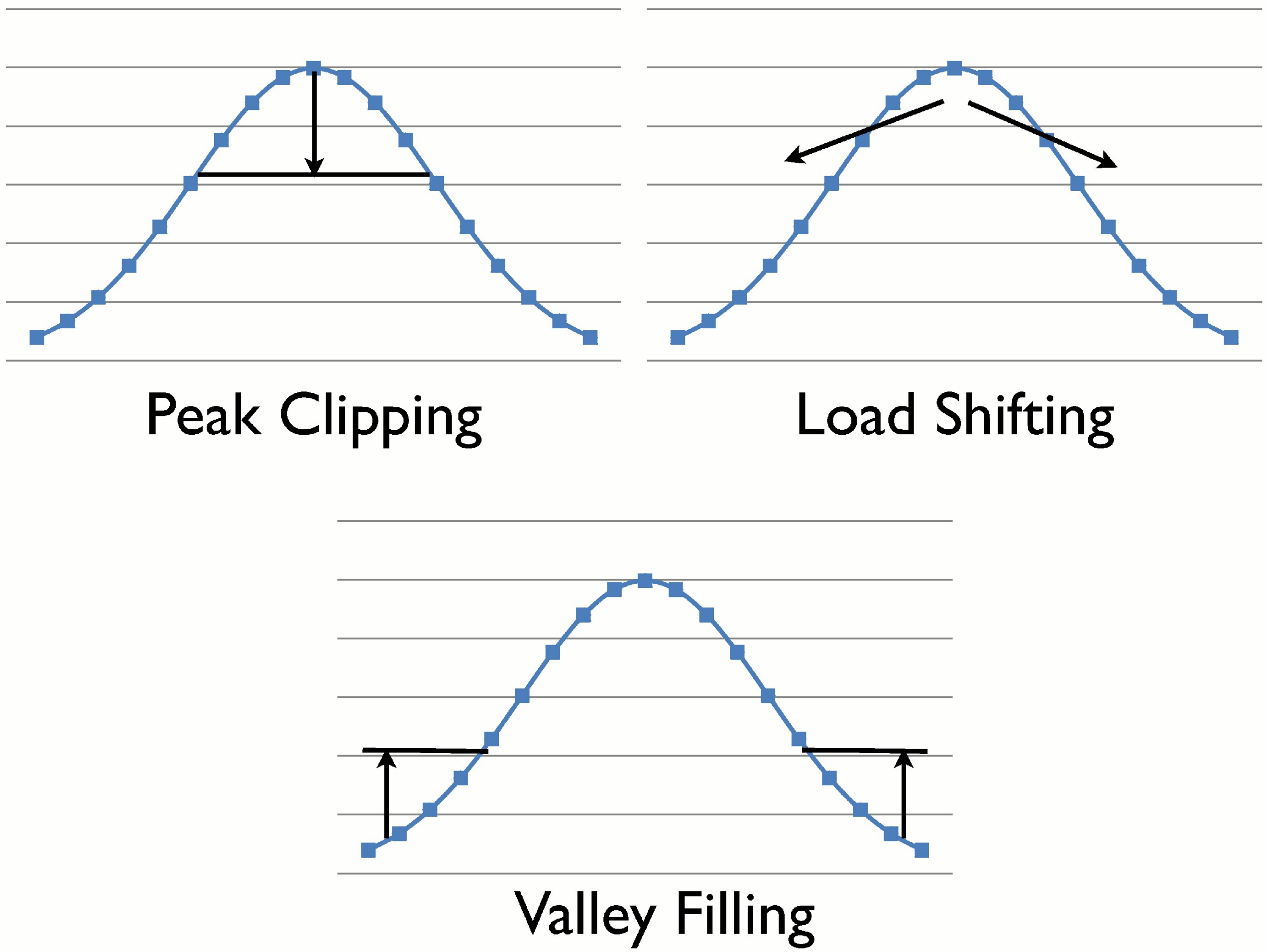
Economic Dispatch



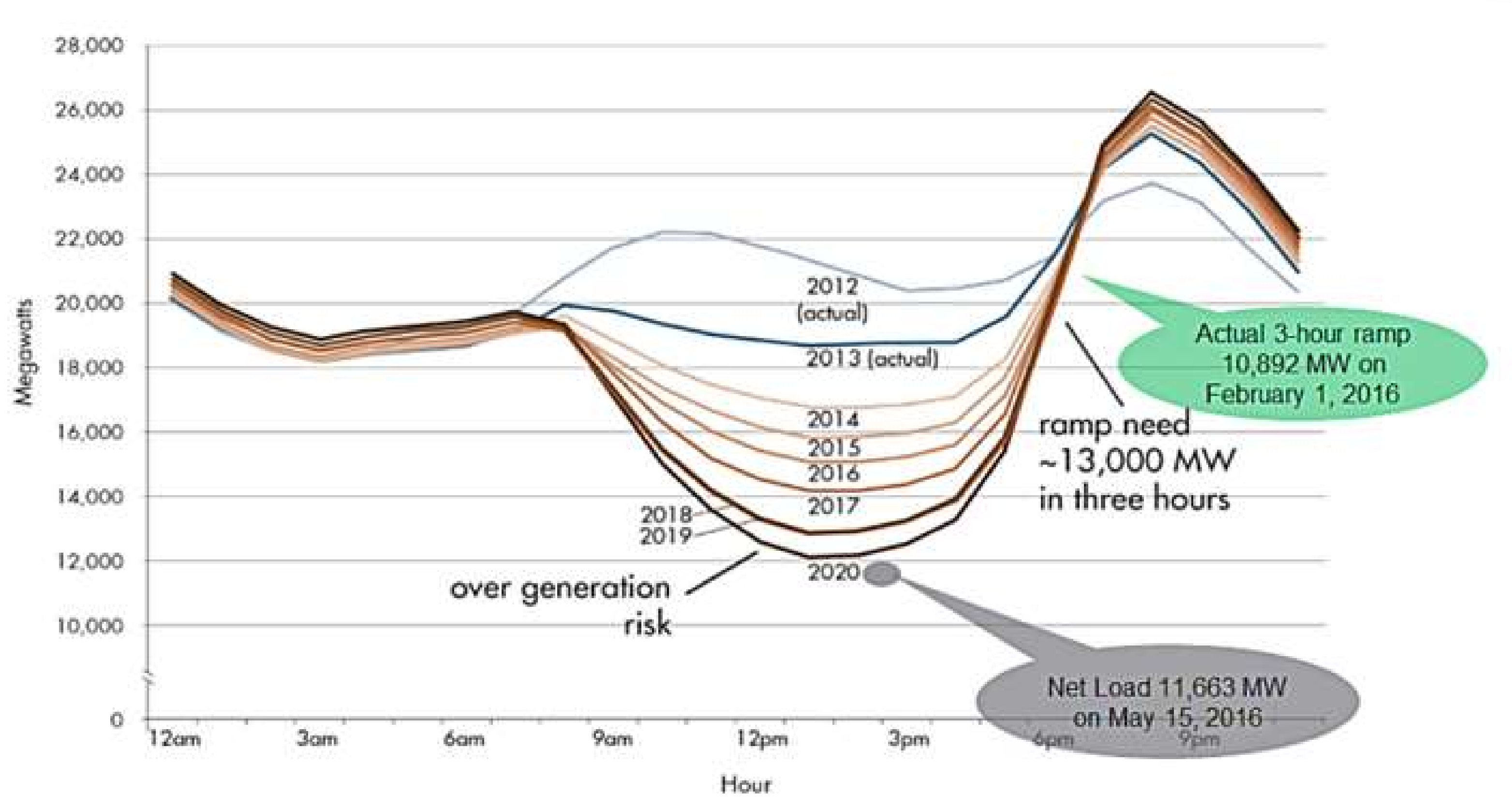
Generation Construction Cost



Utility Load Management



Generation Ramping – The Duck Curve



NERC Reliability Standards

- BAL Standards: Real Power Balancing and Frequency Response
  - Depending on the severity of the event, a Balancing Authority has about 15 to 30 minutes to address the deviation, balance the grid, and restore it back to its previous value or potentially face a load shedding event to correct the deviation.
- IRO Standards: Interconnection Reliability Operations
  - Develop and Plan Transmission Line Outages and Inspections while ensuring adequate transmission paths are available across interconnection tie points.
- TPL Standards: Transmission System Planning
  - The system must be operated in such a way to ensure that there are redundant generation and or transmission paths available to maintain the stability of the balancing area and ultimately maintain the stability the entire interconnection (east or west).
- Violations can result in fines up to $1,000,000 per day

Rate Case Process – 270 Days

1) Utility files rate case application, exhibits, testimony and proposed rates
2) NCUC suspends rates and schedules customer and evidentiary hearings
3) Public Staff engages in discovery, audits/investigates, files testimony
4) Intervenors engage in discovery and file testimony
5) Settlement discussions may occur between parties
6) Customer and evidentiary hearings
7) Parties file proposed orders
8) NCUC reviews all evidence and issues order
9) Utility puts new rates into effect

General Ratemaking

- Utility base rates established pursuant to N.C. Gen. Stat. § 62-133
  - Must be just and reasonable
- Based on the cost of service in the test period, adjusted for non-recurring or non-representative costs
- Rates are established to recover future costs based on what the utility has already spent
  - Utilities typically do not recover expenses and capital costs in advance **or** after the fact

Least Cost Requirement

- N.C. Gen. Stat. § 62-2(3a) requires "…energy planning and fixing of rates in a manner to result in the least cost mix of generation and demand side reduction measures which is achievable…"
- Look for the reasonable least cost means of capacity construction, energy production and regulatory compliance
- This does not mean utilities buy the cheapest thing
  - Balance short-term and long-term costs
    - Consider reliability, maintenance, replacement, estimated obsolescence
  - Present value calculations

Test Year

- Financial data from a historical 12-month period
    - Serves as a proxy for the anticipated level of costs for the period of time the rates will be in effect
    - Pro forma update to include period prior to the hearing
- Example:
    - Rate case filed on March 31, 2016
    - Hearing date of August 1, 2016
    - Test year of January 1, 2015 – December 31, 2015

General Ratemaking Formula

- **Revenue Requirement** is determined as (**Rate Base** x **Rate of Return** (grossed up for income taxes)) + **Expenses**

- **Rate Base** – value of the property (net of depreciation) on which a utility may earn a rate of return.

  - Must be "used and useful" - Power plants, transmission and distribution lines, etc. actually used in providing service to customers

- **Rate of Return** – % return that utility may earn on invested capital, including debt and equity investments.

- **Expenses** – can recover reasonable and prudent expenses based on an historical test year.

Rate Base

- Rate base is the reasonable and prudent cost of property on which a public utility is authorized to earn its rate of return

- Rate base calculation:

  Original cost of the utility assets (prudent capital investment)

  (minus)

  Accumulated depreciation expense

Original Cost

- Original cost of the assets also includes capital additions since original construction
  - Example: The addition of an emissions control system on a generating plant would be folded into the original cost of the assets when calculating rate base

- The assets included in rate base must be used and useful
  - Utility cannot recover investment if it builds assets that it does not need
  - Reasonable planning horizon is allowed

Accumulated Depreciation

- Capital investment is recovered through the depreciation expense established in the test year
- Accumulated depreciation expense deducted from original cost to avoid double recovery

Utility Assets in Rate Base

- Generation facilities
- Transmission lines
- Distribution lines
- Transformers and substations
- Meters
- Computer and software systems
- Vehicles
- Equipment
- Buildings
- Pipelines
- Working capital

Rate of Return

- Percentage return that the utility is allowed to earn on its invested capital
- Designed to compensate investors for the use of their capital and associated risk
- Rate of return composed of three components:
    - Cost of equity
    - Cost of debt
    - Capital structure (debt and equity ratios)
- Rate of return is not a guaranteed return → it is the return the utility is authorized to earn
    - Rates are calculated using the rate of return

Rate of Return – Cost of Debt

- Debt is considered less risky than equity
  - Debt has senior claim on utility earnings
    - If utility bankrupts, debt holders are paid out before equity owners
- Lower risk results in lower required rate of return for debt as compared to equity
- Cost of debt calculation is straightforward
  - Based on the coupon (interest) rate of the debt
- Interest on debt is tax deductible
- Influenced by utility's corporate credit rating and risk profile
  - Standard & Poor's (AAA to D)
    - Duke Energy Carolinas: A-
    - Duke Energy Progress: A-
    - Dominion Energy: BBB+
    - Dow Jones US Utilities average: BBB+
  - Fitch (AAA to D)
  - Moody's (Aaa to C)

Rate of Return – Cost of Equity

- Equity is considered more risky than debt
  - Equity has junior claim on utility earnings due to the contractual nature of debt
    - Shareholders get what is left once everyone else has been paid
- Higher risk → Higher rate of return required to induce investors to bear the risk
- Cost of equity is not tax deductible
- Cost of equity cannot be precisely calculated
  - Methodologies for estimating cost of equity
    - Discounted Cash Flow (DCF)
    - Capital Asset Pricing Mechanism (CAPM)
    - Risk Premium model

Cost of Equity: Risk

- Typical utility risks include:
  - Disallowed cost recovery
  - Regulatory lag
  - Environmental regulations
  - Flotation costs
  - Disruptive technologies
  - Stranded costs
  - Commodity risks

Cost of Equity: Risk

- Utility cost of equity is generally lower than unregulated businesses
- Utilities are considered less risky than other businesses
  - Utilities can file a rate case to recover reasonable and prudent investment/expenses
    - Unregulated companies are at mercy of market forces
  - Electricity, water and sewer are daily necessities with sustained, predictable demand
    - Food, computers, vehicles, clothes and entertainment are more fungible
- Greater use of riders and other rate recovery mechanisms outside a rate case reduces utility risk, which reduces cost of equity

Rate of Return – Capital Structure

- Ratio of debt to equity impacts the ultimate cost to ratepayers and must be balanced appropriately
  - Since equity is more costly than debt, a higher percentage of equity will result in higher rates
  - BUT the cost of equity increases as a company adds more debt, which offsets the savings
- Typical capital structure ratio for ratemaking is 50:50
- Utilities Commission can impute capital structure for ratemaking purposes
  - Example: Utility A is capitalized with 65% equity and 35% debt. NCUC could establish rates by applying a 50% equity and 50% debt ratio to the rate base. This would result in lower rates for customers when compared to the actual capitalization ratio.

Rate of Return – Example Calculation

- Utility A has a capital structure of 55% equity and 45% debt
- Cost of equity estimated at 10%
- Income tax rate of 40%
- Cost of debt calculated at 4%
- Rate base is $3,000,000,000
- Overall rate of return = 7.30%

Type of Capital	Capital Structure Ratio %	Cost Rate %	Weighted Cost %	Income Tax Gross-Up	Pre-Tax ROR %
Equity	55.00%	10.00%	5.50%	1.67	9.17%
Debt	45.00%	4.00%	1.80%	1.00	1.80%
Total	100.00%		7.30%		10.97%

- Pre-tax return (includes income tax gross-up) on rate base = $3,000,000,000 * 10.97% = $329,100,000

Expenses

- Ongoing level of expenses going forward based on the expenses incurred during the test year
  - Pro forma update to include known changes in expense levels between filing and hearing
- Adjustments to test year expenses are common
  - Common disallowances include:
    - Portions of executive salaries and bonuses
    - Lobbying costs
    - Public relations
    - Charitable expenses
    - Incentive expenses
    - Expenses not representative of expected expense levels going forward

Expenses

- Utilities are authorized to recover reasonable and prudent expenses
  - Maintenance expense
  - Operating expense
    - Depreciation
    - Salaries
    - Fuel
    - Transportation
    - Customer service
    - General taxes
    - Administrative
    - Uncollectibles
    - Testing
    - Legal
    - Rate case expenses
    - Purchased power costs
    - Unbundled QF power costs

Depreciation Expense

- Depreciation amount charged during the test year
- Designed to recover the cost of the property over its estimated life
- If item is fully depreciated but remains in utility service, there is no depreciation expense in the test year
  - Just because it is fully depreciated does not mean it is retired
  - Utility has fully recovered its capital investment and the rate of return
  - No longer earn rate of return on such property going forward

Depreciation Rate

- Depreciation rate = (Cost of asset + cost of removal – salvage value) / Life of the plant asset
- Sample asset lives:

Coal generating plant: 60 years	Natural gas combined cycle: 40 years
Transmission facilities: 60 years	Distribution facilities: 40 years
AMI meters: 15 years	Computers: 5 years

- Example depreciation rate for AMI meter
  - ($250 + $10 - $5) / 15 years = 17%
  - In year 10, only $38.80 will be capital investment eligible for rate of return

Depreciation Example

- AMI meter
- Assume the following
  - $250 cost for AMI meter
  - $10 cost of removal at end of life
  - $5 salvage value
  - 15 year life
  - 7.5% weighted cost of capital
- ($250 + $10 - $5) / 15 years = 17% depreciation rate
- Year 1: $250 of capital investment eligible for rate of return
  - $250 * .075 = $18.75 return on investment
- Year 11: $46.73 of capital investment eligible for rate of return
  - $46.74 * .075 = $3.51 return on investment

Cost Components

- Demand
  - Production, transmission and distribution facilities
  - Tend to be fixed in nature
- Energy
  - Fuel expense, purchased power, generator maintenance
  - Vary with the number of kilowatt-hours generated
- Customer
  - Function of number of customers
  - Includes minimum system components necessary to provide electric service to customer-specific locations

Cost Allocation Methodologies

- Summer coincident peak
  - Customer's share of the system load at the system's summer peak
- Winter/summer coincident peak and average demand
- Non-coincident peak and average demand
- Twelve months peak average
  - One peak each month, or
  - Average of twelve highest peaks during year

- North Carolina allocates based on load demand at <u>summer coincident peak</u>

Rate Design

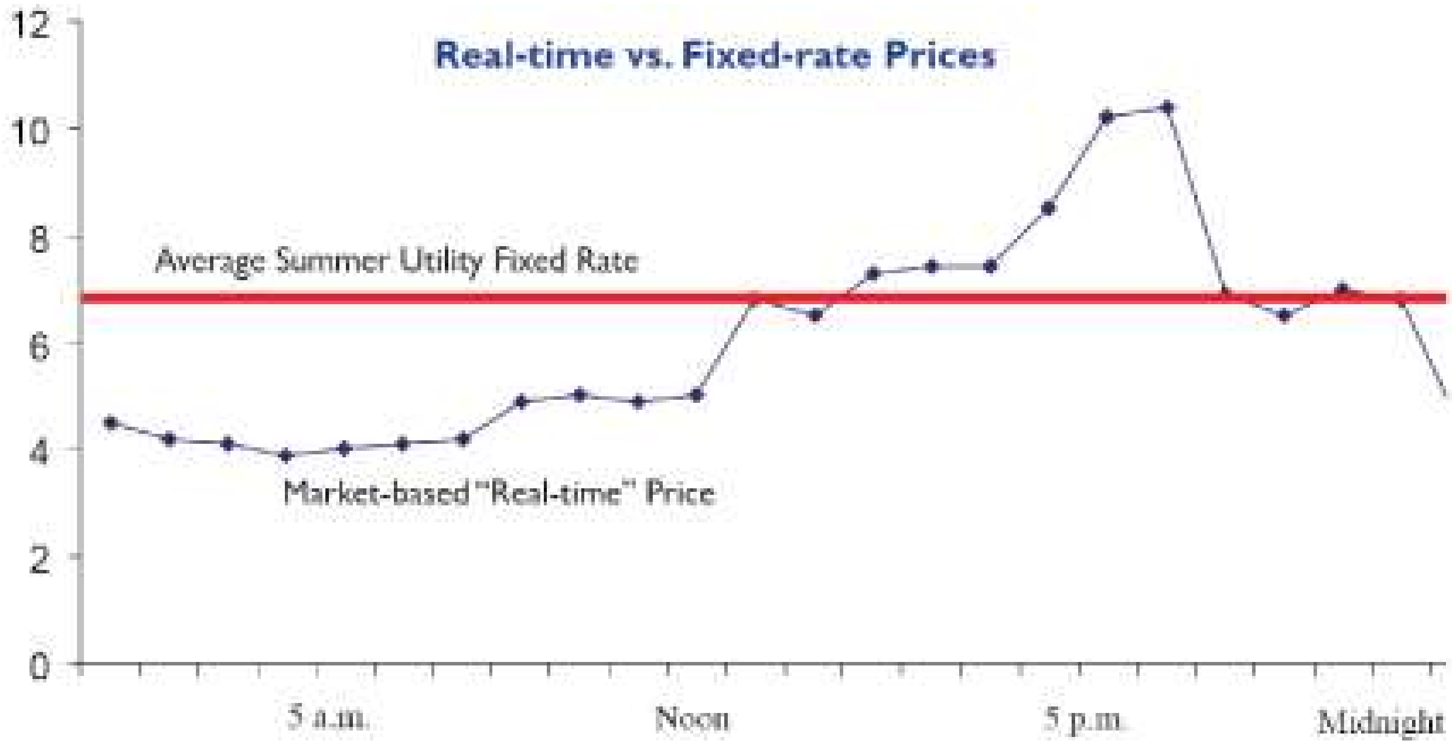
- Rates established to meet the revenue requirement
  - Customer rate classes
    - Residential
    - Commercial
    - Industrial
  - Designed to mirror the cost of service to each class
    - Various rate schedules in each customer class
- Average NC retail price of electricity per customer class
    - Residential: 10.49 cents/kWh (National average: 12.22 cents/kWh)
    - Commercial: 8.41 cents/kWh (National average: 10.19 cents/kWh)
    - Industrial: 6.11 cents/kWh (National average: 6.57 cents/kWh)

Source: Energy Information Administration (January 2017)

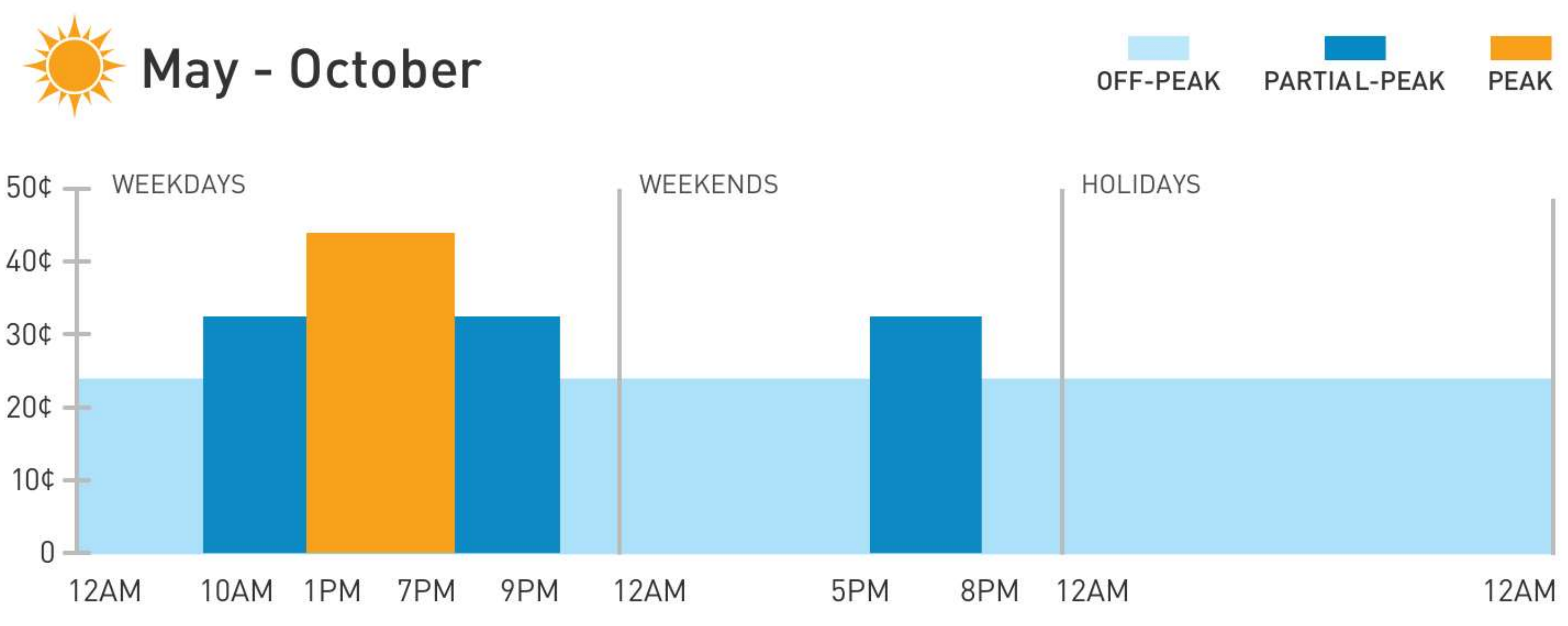
Tariff Designs

- Standard service
  - Small fixed charge
  - Rates do not vary based on cost of generation resource or system demand
- Real Time Pricing
  - Rates fluctuate hourly and are tied to actual generation cost
  - Higher prices when demand is higher
  - Requires a smart meter (two-way)
  - When you use energy is as important as how much you use
- Time-of-Use
  - Prices fixed based on typical demand periods
  - Rates are higher during period when demand is higher
  - When you use energy is as important as how much you use

Real Time Rates



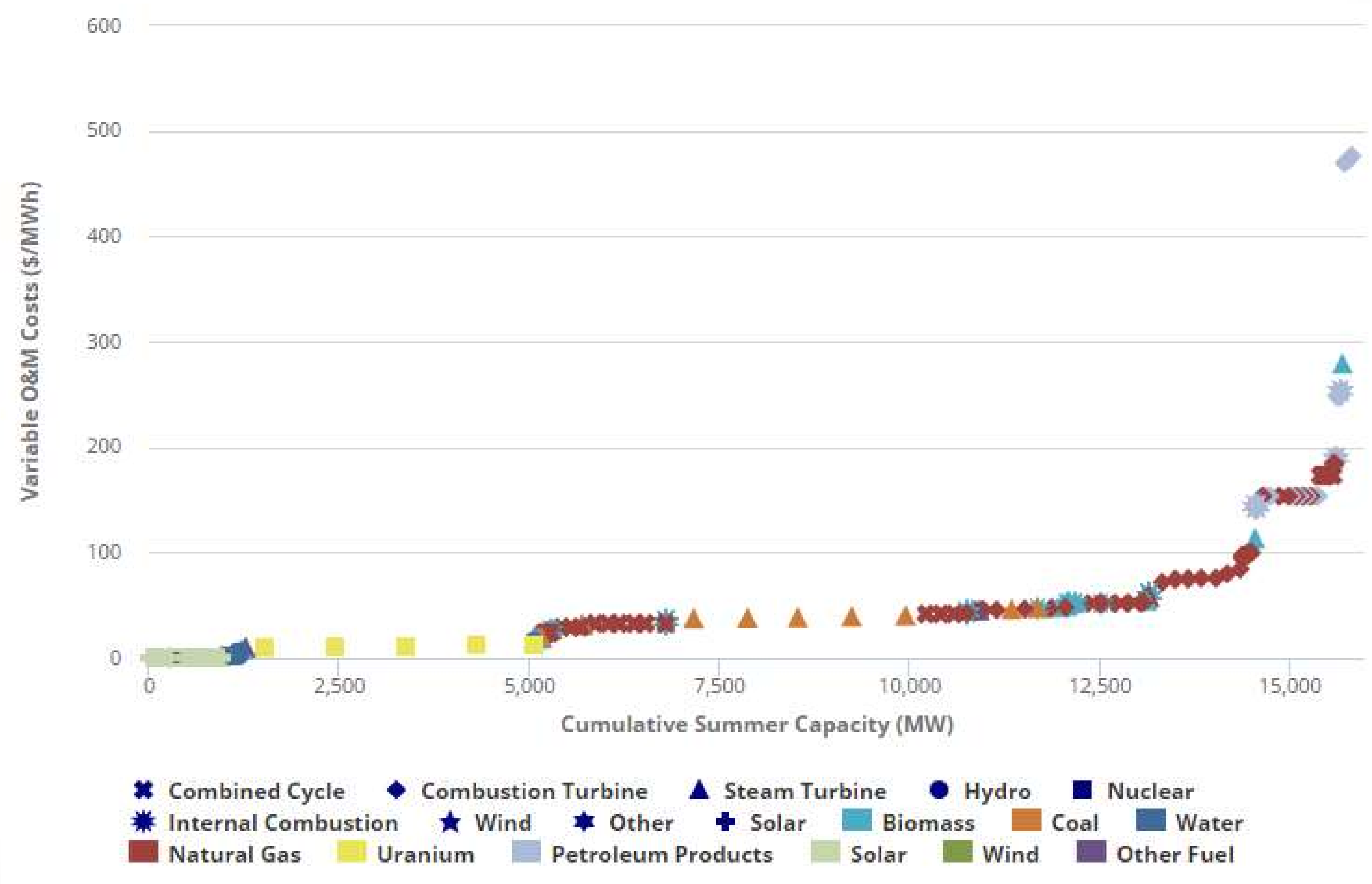
Time-of-Use Rates



Tariff Designs

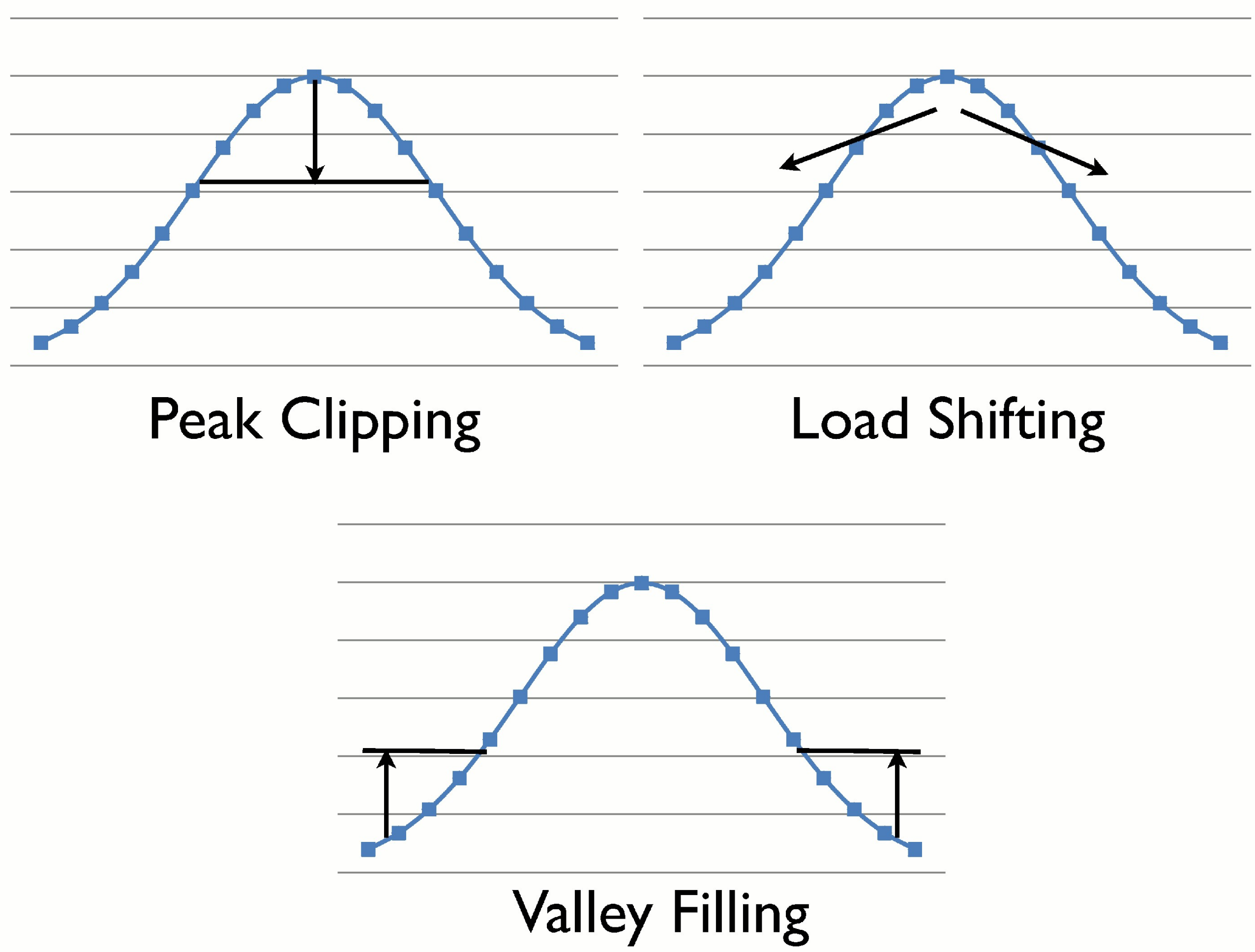
- Critical Peak Pricing and Rebate
  - Higher pricing or rebate during critical times
- Curtailable Service
  - Lower rate in exchange for ability to be curtailed a certain number of hours each year
  - Premium charge if exceed demand during curtailment period
- Co-Generation
  - Customer self-generation allows customer to shave peak load
  - Demand and standby charges

Economic Dispatch Revisited



Duke Energy Progress 2015

Customer Load Response



Fixed and Variable Costs

- Rate design includes fixed and variable components
  - Fixed (minimum) charges on the bill tend to be low
    - Designed to ensure customer pays a certain portion toward the fixed cost of the system
    - Do not reflect the true fixed cost of the system to serve the customer
    - Much of the fixed cost is recovered through the variable component
  - Variable charges can be influenced by customer behavior
    - Largest variable cost is fuel

Fixed v. Variable Challenges

- Altering the allocation changes the winners and losers
- Higher fixed cost → discourages conservation
  - Could necessitate additional plant construction to meet demand, which increases rates
- Lower fixed cost → some customers may pay less than the true fixed cost the utility incurs to serve them
  - Cost recovery shifted to higher energy users
- Lower variable → helps and hurts low income customers
  - Hurts customers that are able to use less energy
  - Helps customers that cannot afford energy efficient measures

Other Ratemaking Concepts

- Construction Work in Progress (CWIP)
  - Generally not included in rates until construction is complete and the plant is in service
- Allowance for Funds Used During Construction
  - Utility is allowed to accrue financing costs (debt and equity return) on the funds used for construction
    - Included in rate base along with the capital costs once project is complete
      - In certain circumstances, the financing costs incurred-to-date can be recovered as CWIP in a general rate case before the project is complete
- Early Retirement/Abandoned Plant
  - Unrecovered costs can be recovered when the early retirement/abandoned plant decision is deemed reasonable and prudent
    - NCUC has allowed sharing of risk by disallowing rate of return on the amount recovered

Regulatory Assets (Deferrals)

- Deferred Expenses
  - Regulator may allow a utility to record costs that would normally be expensed as an asset (called a regulatory asset)
    - Applies to both revenues and expenses
    - Must demonstrate the costs in question would have a material impact on the utility's earnings and overall financial condition absent the deferral
      - Utility must be earning below its authorized rate of return
    - Can include a rate of return on the deferred amount
  - Rates set by a regulator at a later date include recovery of the regulatory asset
  - NCUC has said these should be used sparingly

Fuel Rider

- Cost of fuel burned
  - Coal, gas, nuclear, biomass
- Cost of reagents used to treat emissions
- Certain purchased power costs*
  - Replacement power costs
  - Peak power purchases
  - Transmission charges
- Costs of energy and capacity purchased from qualifying facilities (QFs)*
- Net gains/losses from sale of fuel, fuel components or by-products*
- Renewable energy procurement non-administrative costs*

*Limited to 2.5% annual increase in the aggregate amount of costs

Renewable Energy/Energy Efficiency Portfolio Standard Rider

- Incremental costs to comply with Renewable Energy Portfolio Standard (bundled costs minus avoided costs)
- Costs of Renewable Energy Certificates (RECs)
- Costs recoverable are capped by General Assembly
  - Beginning on January 1, 2015
    - Residential rates: $27/year
    - Commercial rates: $150/year
    - Industrial rates: $1,000/year

Demand Side Management (DSM)/Energy Efficiency (EE) Rider

- Costs of DSM/EE programs
  - LED bulbs
  - Refrigerator recycling program
  - Home energy audits
  - Load control
- Net lost revenues
  - First three years of program
- Utility incentives
  - Earn rate of return on energy efficiency expenditures similar to invested capital

DSM/EE programs – Cost Effectiveness Tests

- Participant Cost Test (PCT)
  - Will the participant-customer benefit from installing the measure?
- Utility Cost Test (UCT)
  - Will the administrative cost to the utility increase?
- Ratepayer Impact Measure Test (RIM)
  - Will utility rates increase?
- Total Resource Cost Test (TRC)
  - Will the total costs of energy in the service territory decrease?

- North Carolina uses the TRC as the primary test
  - Utility required to provide analysis of PCT, UCT, RIM and TRC
  - UTC used to determine the incentive payment to utility

Applying Cost Effectiveness Tests

- DNCP requested DSM/EE program approval (2013)
  - Residential Heat Pump Upgrade
  - Residential Home Energy Check Up
    - Did not pass Utility Cost Test (UTC)
    - Did not pass Total Resource Cost Test (TRC)
  - Residential Duct Testing and Sealing
    - Did not pass Total Resource Cost Test (TRC)
  - Non-Residential Energy Audit
  - Commercial HVAC Upgrade

- NCUC approved programs as a portfolio because the cumulatively met the cost-effectiveness tests

Joint Agency Asset Acquisition Rider

- Recovers the costs associated with Duke Energy Progress' purchase of generation assets from the North Carolina Eastern Municipal Power Agency in 2015
- Adjusted annually to reflect savings/expense associated with changes in the fuel cost

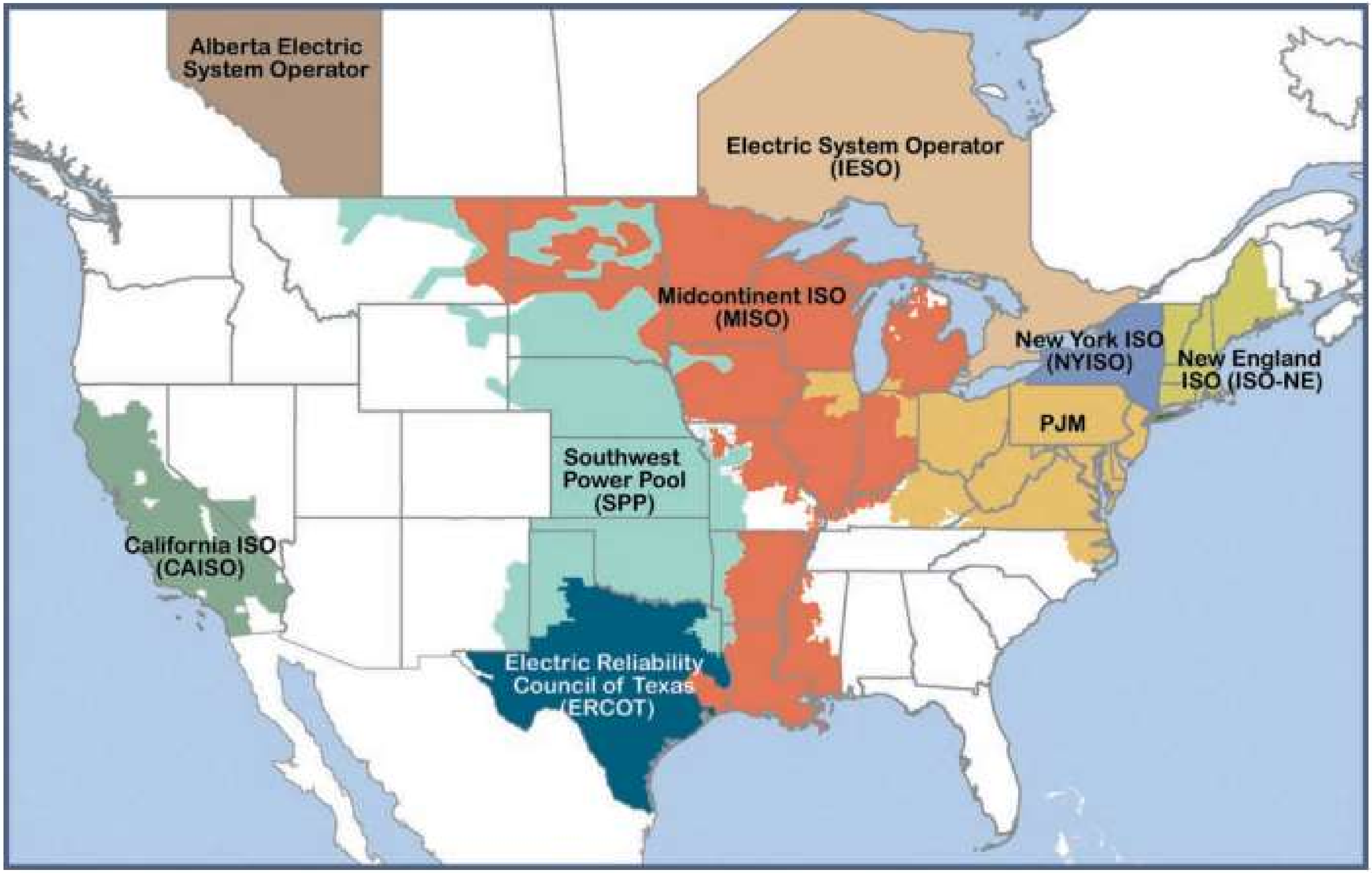
Regulated v. Retail Competition

- Vertically integrated utilities
  - Same utility provides generation, transmission and distribution services
  - Customer must take service from the utility that holds the franchise for the geographic area
  - North Carolina is a vertically integrated state
- Retail competition
  - Different utilities own and provide generation and transmission/distribution services
  - Customers can choose between generators, but must also select and pay a separate transmission/distribution utility to deliver the power

Regional Transmission Organizations (RTOs)

- Wholesale energy market
- Voluntary organization that coordinates energy supply with demand
  - Plan, operate, dispatch and provide transmission service for the region
  - Load serving entities bid-in demand
  - Generators bid in their assets to meet demand
    - Last bid that satisfies demand sets the market price
- Day-ahead, hour-ahead and real time markets

Regional Transmission Organizations



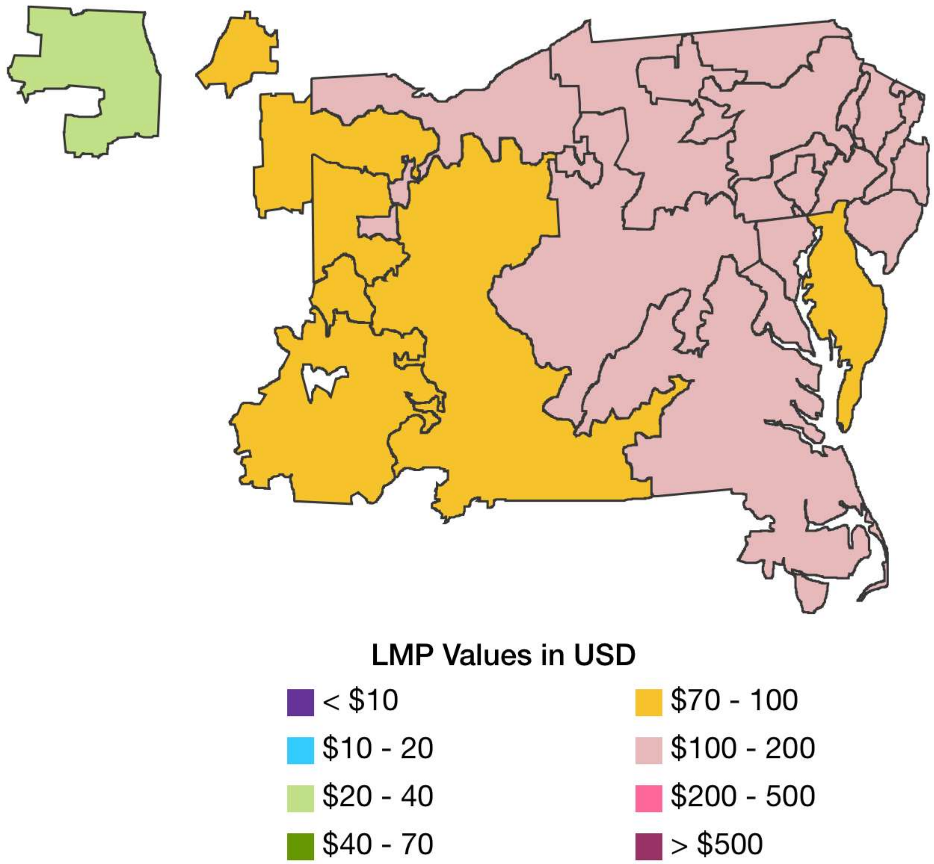
PJM

- Pennsylvania, New Jersey, Maryland Power Pool
- Serves 61 million people in 13 states and D.C.
- Dominion Energy is located within PJM's service territory
  - Northeastern corner of North Carolina
  - Approximately 120,000 customers
  - Dominion is vertically integrated utility and is regulated by NCUC

Locational Marginal Pricing

Zone LMP

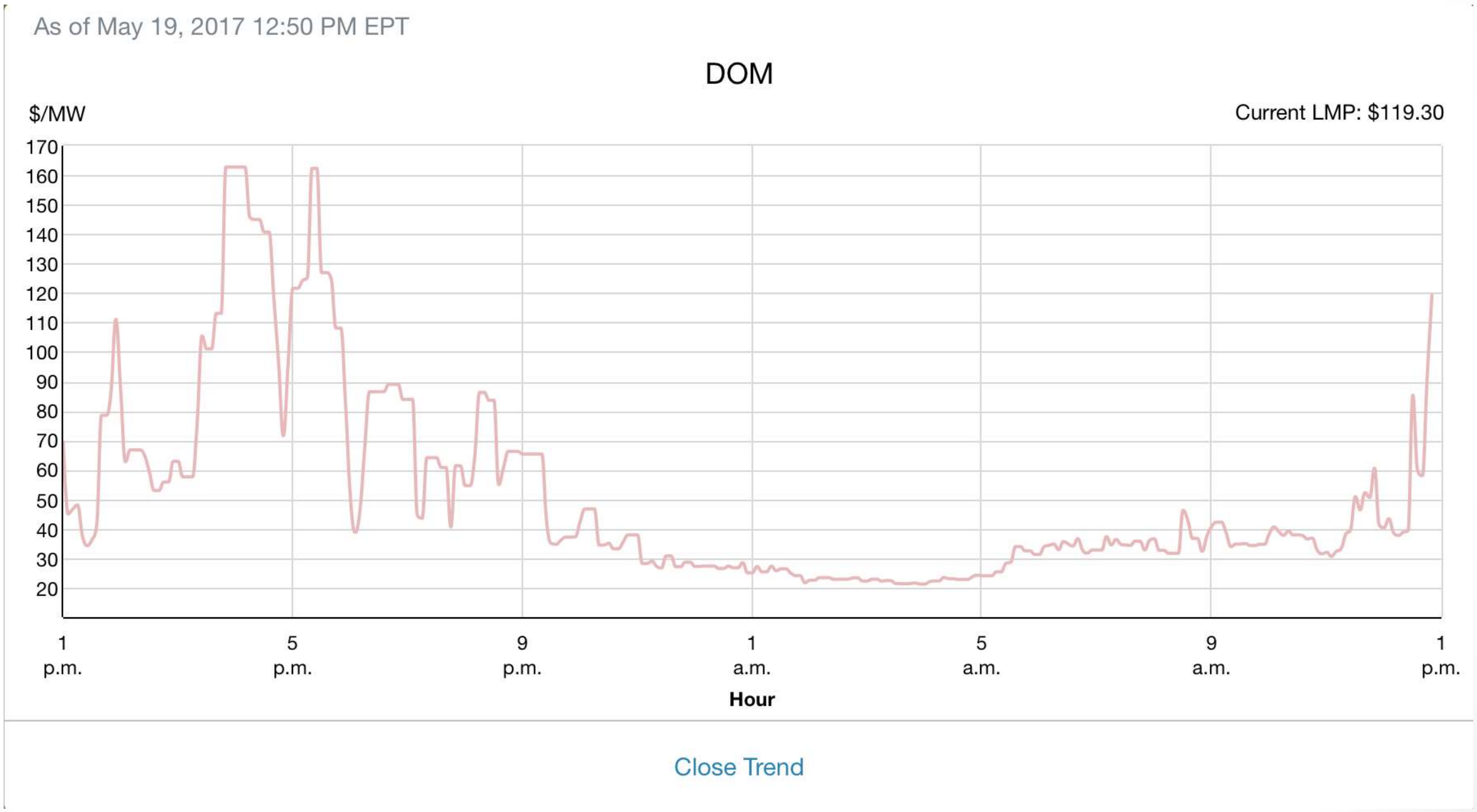
As of May 19, 2017 12:50 p.m. EPT



Edit

Zone/Hub	LMP ($/MW)
WESTERN HUB	139.34
AE	129.77
AEP	80.39
APS	132.07
ATSI	144.97
BGE	131.15
COMED	32.29
DAYTON	70.57
DEOK	74.63
DOM	119.30
DPL	94.23
DUQ	155.53
EKPC	76.28

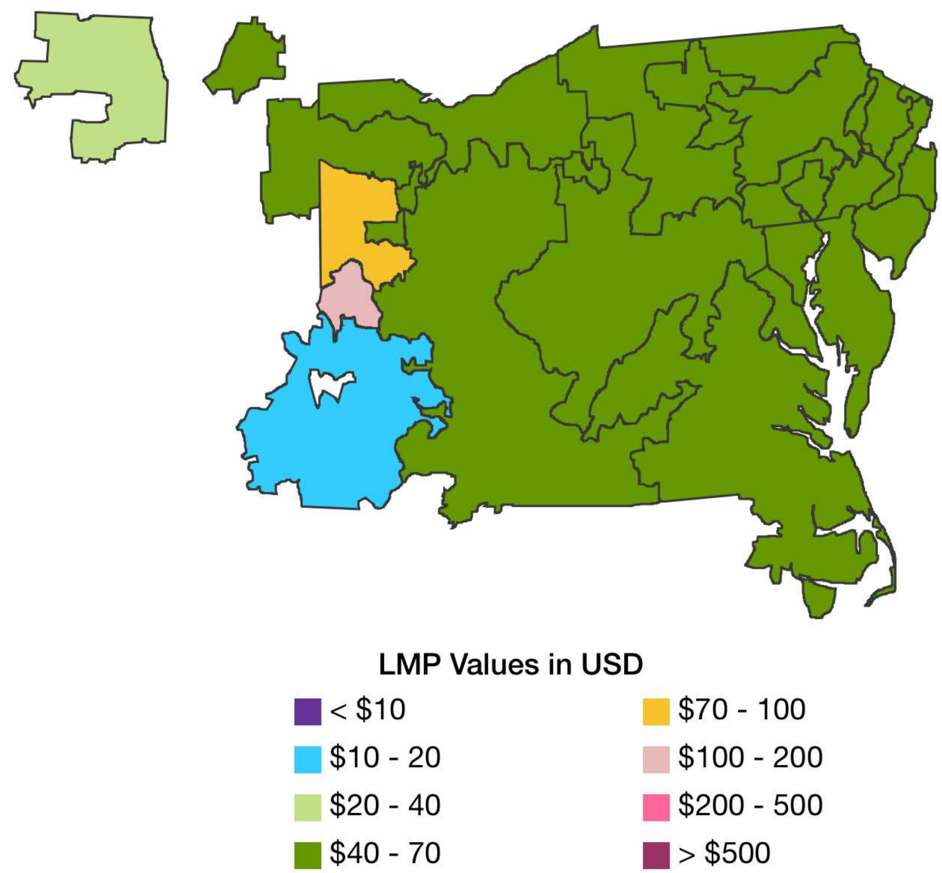
Locational Marginal Pricing



Locational Marginal Pricing

Zone LMP

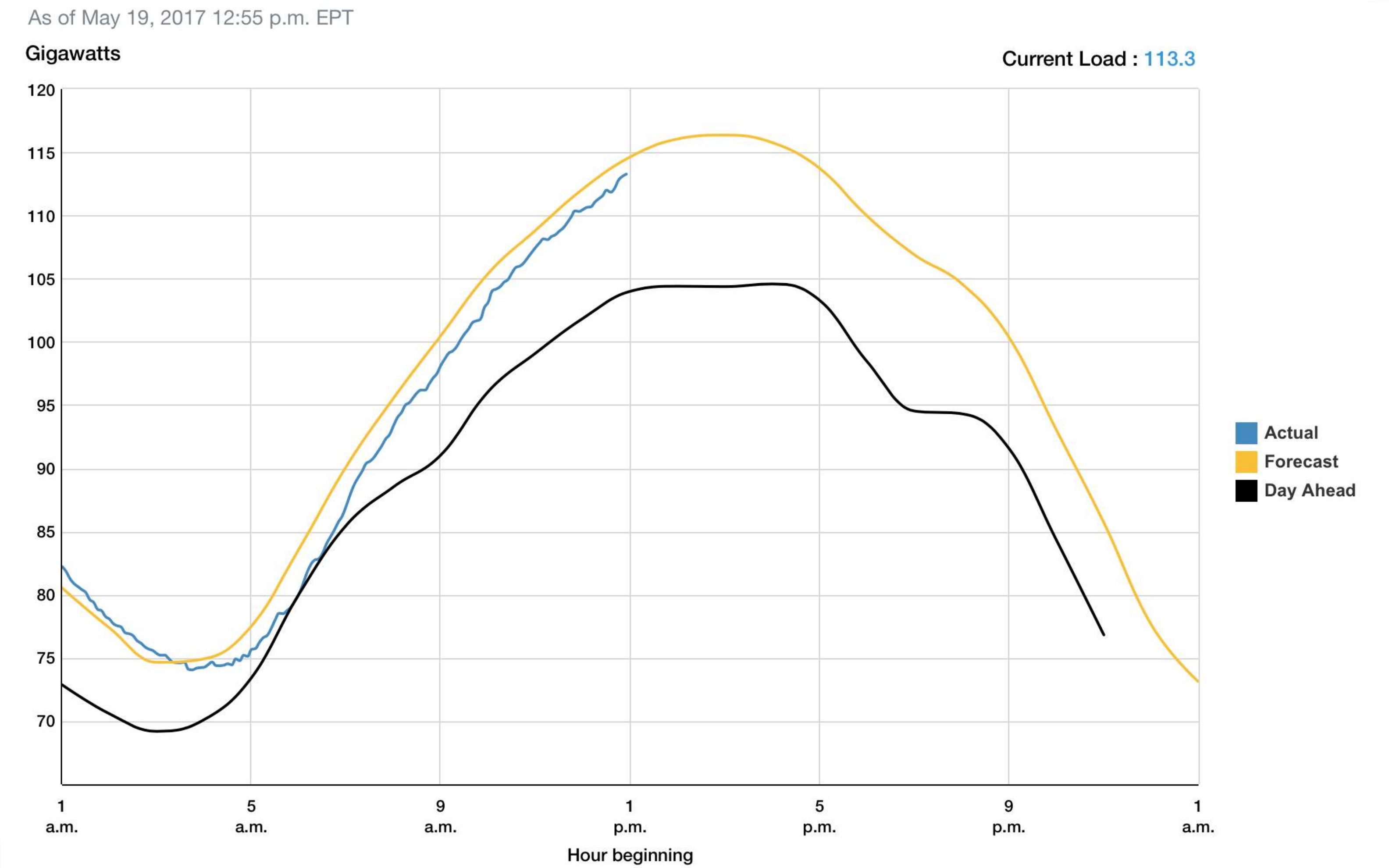
As of May 17, 2017 12:40 p.m. EPT



Edit

Zone/Hub	LMP ($/MW)
WESTERN HUB	45.89
AE	45.50
AEP	47.18
APS	47.32
ATSI	50.91
BGE	46.18
COMED	26.65
DAYTON	74.04
DEOK	144.23
DOM	44.44
DPL	45.87
DUQ	49.03
EKPC	10.34

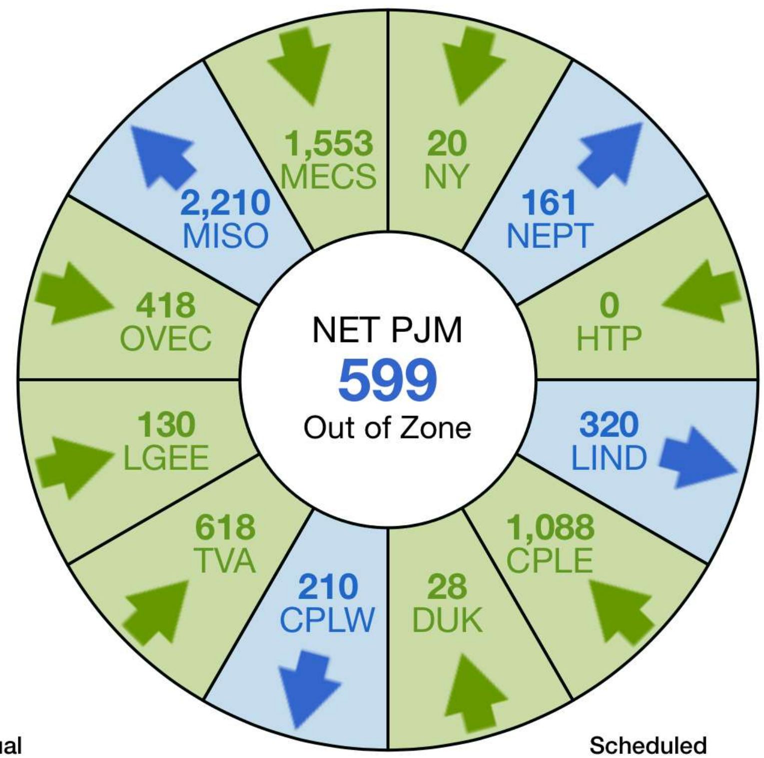
Forecasting and Demand



Loop Flows

Tie Flows

As of May 19, 2017 12:55 p.m. EPT
Consolidated view in MW



Actual
Imports: 2,302
Exports: 2,901

Scheduled
Imports: 720
Exports: 2,118

Control Areas Edit
Shown in MW

Area	Actual	Scheduled	Loop Flow
CPLE	1,088	214	874
CPLW	210	0	210
DUK	28	257	229
HTP	0	0	0
LGEE	130	249	119
LIND	320	315	5
MECS	1,553	96	1,457
NY	20	76	96
OVEC	418	18	436
MISO	2,210	1,628	582
NEPT	161	60	101
TVA	618	21	639

PJM RTO

Public Utility Regulatory Policies Act of 1978

- Defines Qualifying Facilities (QFs)
    - Small power production facilities 80MW or less and whose primary energy source is renewable resources
    - Co-generation facilities sequentially producing electricity and another useful form of thermal energy
- Electric utilities "must purchase" electricity and capacity generated by QFs
  - Can be excused if access to sufficiently competitive market exists
    - IE: PJM, MISO, etc.
  - Electricity is purchased from QFs at the utility's avoided cost
    - Established by state utility commission for regulated utilities
- Electric utilities "must sell" electricity and capacity when requested by a QFs

Avoided Cost Rates

- Incremental cost a utility would incur to generate or purchase the next kilowatt or kilowatt-hour of electricity
  - Cost of building the capacity
  - Cost of generating the energy
- "Avoided" because the utility has procured the electricity from another source rather than incurring the cost to produce the electricity itself
- Established for regulated electric utilities by the NCUC not less than every two years

How is Avoided Cost Calculated?

- North Carolina uses the Peaker Method
  - Capacity calculation based on the cost (per kW) of building a new peaking unit
    - Natural gas combustion turbine (peaking unit)
  - Energy calculation based on marginal system energy cost
  - Avoided cost elements must be "known and quantifiable"
- Variable and long-term fixed rate options
- Capacity payments are paid only for peak hours during which the unit is producing electricity

Sample Avoided Cost Tariff

Option A

Administrative Charge $19.91 per month

Interconnection Facilities Charge

The Interconnection Charge for each customer is set forth in the Agreement as outlined in the Terms and Conditions; however, the $25.00 minimum will not apply if the charge is for a meter only.

Interconnected to Distribution System:		Fixed Long-Term Rate (a)		
I. Capacity Credit	Variable Rate	5 Years	10 Years (a)	15 Years (a)
a. All On-Peak Energy per On-Peak Month per kWh:				
i. Hydroelectric facilities with no storage capability and no other type generation	3.34¢	3.45¢	3.64¢	3.82¢
ii. for all other hydroelectric and all non-hydroelectric facilities	2.00¢	2.07¢	2.19¢	2.29¢
b. All On-Peak Energy per Off-Peak Month per kWh:				
i. Hydroelectric facilities with no storage capability and no other type generation	1.67¢	1.73¢	1.82¢	1.91¢
ii. for all other hydroelectric and all non-hydroelectric facilities	1.00¢	1.04¢	1.09¢	1.15¢
II. Energy Credit				
a. All On-Peak Energy per Month per kWh:	4.05¢	4.31¢	4.87¢	5.28¢
b. All Off-Peak Energy per Month per kWh:	3.07¢	3.17¢	3.79¢	4.20¢

Interconnected to Transmission System:		Fixed Long-Term Rate (a)		
I. Capacity Credit	Variable Rate	5 Years	10 Years (a)	15 Years (a)
a. All On-Peak Energy per On-Peak Month per kWh:				
i. Hydroelectric facilities with no storage capability and no other type generation	3.26¢	3.37¢	3.56¢	3.73¢
ii. for all other hydroelectric and all non-hydroelectric facilities	1.96¢	2.02¢	2.14¢	2.24¢
b. All On-Peak Energy per Off-Peak Month per kWh:				
i. Hydroelectric facilities with no storage capability and no other type generation	1.63¢	1.69¢	1.78¢	1.87¢
ii. for all other hydroelectric and all non-hydroelectric facilities	0.98¢	1.01¢	1.07¢	1.12¢
II. Energy Credit				
a. All On-Peak Energy per Month per kWh:	3.95¢	4.21¢	4.76¢	5.16¢
b. All Off-Peak Energy per Month per kWh:	3.01¢	3.10¢	3.71¢	4.11¢

Sample Avoided Cost Calculation

- 3MW solar facility under 10 Year Contract
- Connected to Transmission System
- Utilizing Option A
  - Peak hours: Monday – Friday
    - 7:00 AM to 11:00 PM
  - Peak months: June – September; December – March
- 28% Capacity Factor over 24 hour period/366 days

<u>Avoided Energy Cost payment</u>

Off-peak [$0]= 3,000kW * 4,176 hrs * .00 * .0371
On-peak [$276,369]= 3,000kW * 4,608 hrs * .42 * .0476

<u>Avoided Capacity Cost payment</u>

On-Peak Energy per On-Peak Month [$82,833]= 3,000kW * 3,072 hrs * .42 * .0214
On-Peak Energy per Off-Peak Month[$18,551]= 3,000kW * 1,376 hrs * .42 * .0107

Total annual avoided cost payment = $377,753

How is Avoided Cost Used?

- Rates for purchases from Qualifying Facilities
- Integrated Resource Plans
  - Allows utilities to assign dollar value to their options
- Determining savings from Demand Side Management/Energy Efficiency Programs
  - What did the utility save by avoiding the demand?
- Determining incremental costs of Renewable Energy Portfolio Standards compliance
  - What additional cost did the utility incur above the cost of the energy/capacity?

Consumer Advocate Perspective

- Rates should be based on the **cost of service**
  - How much does it cost to provide safe, reliable service?
  - Should be based on **least cost** means for providing service
- Expenditure decisions should be both **reasonable and prudent**
  - Was the decision to build the plant prudent?
  - Were the costs incurred following the decision reasonable?
- Rates **allocate risk** between customers and utility shareholders
  - What is the appropriate allocation of risk?

Traditional Consumer Expectations

- Customers expect utility service that is:
  - Reliable
  - Safe
  - Reasonably priced
- Value for their money
- Stability and predictability in monthly utility bills
- Timely and responsive customer service
- Quick restoration following outage

Customer Expectations Are Changing

- Greater information regarding their energy usage and bill
  - Mobile applications, real-time data
  - Social media
- Greater control over their energy costs
  - Ability to impact their bill amount through behavioral changes
- Fewer outages and quicker restoration times
  - Information regarding restoration efforts
- Reasonable vegetation management
- Specific customer groups have unique concerns
    - Movement away from fossil-fueled energy generation
    - Ability to purchase from third parties
    - Resistance to smart meters
    - Demand-side management programs